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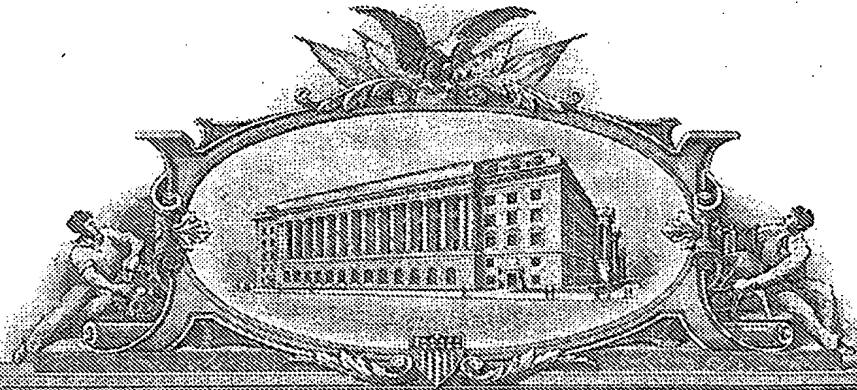
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# PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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☐ Additional inventors are being named on the \_\_\_\_\_ separately numbered sheets attached hereto

## TITLE OF THE INVENTION (500 characters max)

Techniques for labeling of plastic, glass or metal containers or surfaces with polymeric labels employing an activated hydrophilic adhesive layer

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## ENCLOSED APPLICATION PARTS (check all that apply)



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Application Data Sheet. See 37 CFR 1.76

## METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT



Applicant claims small entity status. See 37 CFR 1.27.



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Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

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5     TECHNIQUES FOR LABELING OF PLASTIC, GLASS OR METAL  
CONTAINERS OR SURFACES WITH POLYMERIC LABELS EMPLOYING AN  
ACTIVATED HYDROPHILIC

FIELD OF THE INVENTION

10    This invention relates to polymeric sheets or rolls  
particularly adapted for use as labels in the post mold  
labeling of plastic, glass or metal containers or surfaces.  
More particularly, the present invention relates to  
polymeric film substrates adapted for printing that also  
15    have a hydrophilic surface layer activatable into an  
adhesive layer for use as labels in post mold labeling  
applications using conventional wet applied water based  
labeling equipment typically used for the application of  
paper labels. In another aspect the invention relates to  
20    such labels which possess the beneficial properties of the  
known plastic label substrates, but which are able to be  
applied on conventional post mold paper labeling equipment  
using wet applied water based solutions comprising water,  
water blended with a selected cross-linking agent, adhesives  
25    or adhesives blended with a selected cross-linking agent.

BACKGROUND OF THE INVENTION

Plastic and glass containers or bottles are prevalent in a  
30    wide variety of shapes and sizes for holding many different  
types of materials such as detergents, chemicals, motor oil,  
beer, etc. These containers are glass or plastic (mono or  
multi layers) of polyethylene, polypropylene, polyester or  
vinyl along with other specialty blends for specific barrier  
35    and product resistance performance. Generally such  
containers are provided with a label which designates the  
trade name of the product and may contain other information  
as well. The early art which still is prevalent today  
employed the use of labels manufactured from paper

5 substrates that were applied with a water based adhesive.  
Subsequently, dry pressure sensitive self adhesives and in  
mold labels manufactured from paper have been and continue  
to be used. The shortcomings of paper labels with regard to  
tearing, wrinkling, creasing and the like due to age and  
10 moisture, or due to a lack of deformability when applied to  
a deformable plastic substrate have been well documented in  
the labeling industry. Because of this and the need to  
produce recyclable plastic containers, over the years a  
great deal of effort has been expended to develop container  
15 decoration techniques and durable film substrates which  
would overcome these shortcomings.

Polymeric film facestocks for container decoration which  
have resulted from these efforts can be applied to glass and  
20 plastic containers as self adhesive pressure sensitive  
labels as described in the prior art. The use of self  
adhesive paper and film "pressure sensitive adhesive" (PSA)  
labels that have been preprinted and supported on a release  
liner is not a cost effective option because of the added  
25 cost of the release liner used to support and render  
processable the self adhesive face stock. The cost of this  
type of structure combined with the added cost of disposal  
of the liner does not make pressure sensitive labeling a  
desirable option from an economic or environmental  
30 standpoint for high volume applications. In addition, PSA  
labelers typically run much slower than cold glue labelers  
and capital investment in new labeling equipment is required  
to transition from wet applied Post Mold Labels (PML) to  
self adhesive PSA labels. Also a factor is the effect of a  
35 new process on an existing packaging line in terms of  
learning curve and experience.

Another film face stock labeling technique that has evolved  
is the use of heat activated in-mold labels as described in  
40 the prior art where a preprinted plastic label with a heat

5 activated adhesive is placed in the mold before the molten  
plastic resin is injected or blown into the mold cavity at  
elevated temperature and pressure which activates the  
adhesive and fuses the label substrate to the container in-  
10 mold resulting in a pre-decorated container as it exits the  
mold. The use of polymeric film based in-mold label  
substrates presents a more cost effective alternative than  
self adhesive pressure sensitive labels in terms of  
substrate cost but as this technology has progressed, it has  
15 been found that productivity is impacted by the label  
feeding step into the mold which is performed in a complex,  
continuous and rapid manner which results in large amounts  
of scrap material. Also, the initial capital investment  
required to tool up for a container specific in-mold label  
20 process for new molds and the complex electromechanical  
maintenance intensive feeding devices is significant.  
Another detriment for this process is the potential  
inventory carrying costs for varieties of labeled containers  
that come into play with predecorated containers such as in-  
mold for those who would choose to apply the label  
25 immediately pre or post filled.

Post mold decoration of glass and plastic containers in the  
current art can also be accomplished by direct screen  
printing on the container. Direct screen printing on the  
30 container is not a cost effective process and also presents  
the aforementioned inventory problems along with added cost  
for freight to and from a screen printer. The graphical  
possibilities for label copy are limited in terms of cost  
and quality with this technique. Commodity products can not  
35 support the cost of this labeling technique.

Another post mold technique that has been popular is the  
"Therimage" process. This process transfers a reverse  
printed image from a transfer release sheet under  
40 temperature and pressure to produce decorated containers.

5 The "Therimage" technique of transferring a reverse printed  
image is costly because of transfer sheet costs and presents  
the same disposal problems and costs with the transfer sheet  
as occurs with the aforementioned release liner used in  
10 conjunction with self adhesive labels. Graphic design and  
quality is limited with this technique.

Other techniques for labeling various plastic and glass  
containers with preprinted paper or film label substrates  
include the use of hot melt adhesives (not aqueous) which  
15 are applied to the label substrate or container in a molten  
state with container and substrate subsequently married  
while the hot melt is molten. When the hot melt adhesive  
cools, it sets up and bonds the label substrate to the  
container. This technology requires the use of  
20 sophisticated melting and application equipment that must be  
operated, cleaned and maintained at elevated temperatures.  
This technology works well with complete 360 degree wrap  
around labels but has not evolved to the point to allow  
consistent labeling of a die cut or square cut label with  
25 less than 360 degree wrap. Affixing a cut label to an area  
on a container with 100% or patterned adhesive application  
using hot melt adhesives has not been commercially  
perfected. Complete wrap around hot melt applied labels  
where one end of the label is affixed to the container while  
30 the other end is wrapped around the container and affixed  
with hot melt to the label substrate is proven hot melt  
label application technology that works well for film and  
paper label substrates. This technology does not fit for  
individually labeled panels on a container such a  
35 rectangular oil, contoured detergent or beer containers  
where discrete labels are applied such as a neck label,  
front label or rear label that are not wrapped around 360  
degrees. Another drawback is the added cost for label  
substrate when this technique is used since more label  
40 substrate is required because of the 100% wrap around.

5

Lastly, one of the oldest and still prevalent labeling techniques is the application of paper based labels to glass and plastic containers using natural and synthetic labeling adhesives such as BL300 produced by Henkel Adhesives or  
10 OC363-20 produced by O.C. Adhesives Corp. which are known in the art. This is a safe (water based) proven technology that has grown and been employed for many years and consequently there are many existing machines that have been installed for this type of labeling technique such as from Krones,  
15 Neutraubling, Germany that run cut precut labels or Koyo, Japan which runs roll stock that is cut on machine to the label size. The cut label techniques and associated adhesives work well with paper based substrates applied to glass, plastic or metal containers because the wet adhesive  
20 wicks (absorbs) into the paper substrate from the applicator roll, pad or pallet which breathes and allows the moisture from the water carrier to be absorbed by and dry thru the paper base.

25 This technique obviously will not work well with non-porous polymeric substrates as the adhesive can not wick into the polymeric substrate for initial tack and adhesive transfer to the label or drying thru the plastic. Typically, wet applied cut label machines work where glued pallets remove  
30 the label out of the label holding magazine while simultaneously gluing the back side of the label. This is accomplished by applying a thin glue film to the pallet in a pattern or with 100% coverage which is then pressed in intimate contact against the first label in the stack.

35

After its removal, the label sticks on the entire glued area of the pallet until transferred to a "gripper" cylinder and removed from the pallet typically using a vacuum mechanism. The gripper cylinder then transfers the label to the  
40 container to be labeled. The various machine designs and



5 techniques are well known within the labeling industry and to those skilled in the art. The "Krones Manual Of Labeling Technology" by Hermann Kronseder dated December 1978, is hereby incorporated by reference.

10 In recent years, as described in U.S. 6,663,746 and 6,517,664, which are incorporated by reference, polymeric film labels using a hydrophilic glue receptive layer and a water based adhesive composition are now being used. The applications also describe the concept of rewetting the hydrophilic layer with an aqueous medium (water or adhesive  
15 that may contain a cross-linking agent) to activate the hydrophilic layer into an adhesive layer.

Attempts have been made to use polymeric substrates with high moisture vapor transmission rates (MVTR) and tacky or pressure sensitive adhesive on conventional labeling  
20 equipment with little success. The tacky adhesive required to stick to the water impervious polymeric substrate causes machining problems by gumming up the adhesive application system and creates cleanup issues. The high MVTR substrates also did not have good wet tack with existing commercially  
25 available adhesives that would machine without problems and did not dry rapidly enough making the labels prone to "swimming" or moving from the desired application area during down stream processing. In addition, the adhesives do not wet out and apply uniformly to non hydrophilic surfaces  
30 with the crude adhesive metering and application systems currently in use on existing paper labeling machinery. Without uniform application, wet out and wet tack, it will be impossible to apply a clear label that has the no label look because of adhesive and application imperfections.  
35 Recent developments in radiation curable (not aqueous) adhesives adapted for use on cut and stack labelers referenced in issued and pending patent applications to McNutt et. al. have led to the development of more

5 sophisticated adhesive metering mechanisms and label wipers  
and techniques that can be used to uniformly control  
adhesive deposition and these modifications are contemplated  
for use to apply the aqueous activation medium to the  
activatable layer of the current invention at the minimum  
10 possible level.

The techniques of U.S. 6,517,664 and U.S. 6,663,746 which are  
now being performed commercially and those developed by  
McNutt et al use adhesives applied to the polymeric film on  
the labeling machine to affix the label to the container and  
15 work well for opaque labels. There are still inconsistencies  
and imperfections in the application of the adhesive such as  
bubbles and heavy or light adhesive areas that when applied  
to clear or contact clear substrates appear inferior when  
compared to PSA labels where the adhesive has been pre-  
20 coated on the substrate. In addition, the radiation curable  
adhesives as defined by McNutt et. al. are very costly when  
compared to aqueous systems and in comparison are health and  
environmental unfriendly.

25 Accordingly, it is an object of the invention to provide a  
polymeric label particularly adapted for use in post mold  
wet applied labeling of polymeric, glass and metal  
containers that has a dry non pressure sensitive hydrophilic  
layer uniformly pre-applied that can be activated into a  
30 defect free adhesive layer. This is accomplished by pre-  
applying by coating, coextrusion or extrusion the layer that  
is activated on the labeling machine with an aqueous medium  
to become tacky and function as an adhesive to affix the  
polymeric label to the container. The activated label will  
35 readily feed from the label magazine or gripper, adhere with  
sufficient tack without moving through post labeling  
handling and processing including but not limited to  
conveying, filling, case packing and palletizing.

5 It is a primary object of the invention to provide a  
polymeric label with a pre-applied hydrophilic layer  
consisting of at least 30% dry by weight of animal glue  
activated into an adhesive layer through an aqueous medium  
on the labeler particularly adapted for use in post mold wet  
10 applied labeling of polymeric and glass containers that  
would have sufficient wet tack and affinity for water, a  
water based solution or adhesive used to allow for transfer  
of the water, water based solution or water based adhesive  
to the polymeric label substrate from the applicator  
15 roll(s), pad(s) or pallet(s) of the labeling machine to  
activate it into an adhesive.

It is also an object of the invention to provide an  
activatable polymeric label for use in post mold wet applied  
20 labeling of polymeric and glass containers that would have a  
coefficient of expansion or contraction under the conditions  
which the container sees which is the same or compatible  
with that of the polymeric resin, glass or metal from which  
the container is made so that expansion and contraction of  
25 the container will not wrinkle or otherwise affect the  
integrity of the label.

It is also an object of the invention to provide a polymeric  
label for use in wet applied post mold labeling which would  
30 combine suitable properties of modulus of elasticity and  
flexibility and would not be degraded by handling and  
flexing of the subsequent container. Finally, it would be  
desirable to provide a label for use in wet applied post  
mold labeling of polymeric containers which does not have to  
35 be removed from such containers in order to recycle or  
regrind defective or post consumer polymeric containers.

#### SUMMARY OF THE INVENTION

5

In considering the performance or economic shortcomings of prior art materials, I have discovered an improvement to the process as described in the pending and issued applications by the applicant as cited above by which a polymeric label  
10 with a uniform pre-applied hydrophilic layer comprising at least 30% by dry weight of a animal glue can be activated into a tacky adhesive when wet on the labeler by an aqueous medium and applied to a glass, plastic or metal container or surface in a more consistent and uniform manner than a label  
15 with a non activatable layer that requires a heavy adhesive layer applied on the label machine to function, said method comprising:

- 20 (a) applying a uniform layer of a hydrophilic solid material based on animal glue or a to a polymeric label to form an activatable hydrophilic layer on said polymeric label that can be activated into a tacky adhesive;
- 25 (b) applying a light deposition water, water containing a cross-linking agent, a water based adhesive or a water based adhesive containing a cross-linking agent over said activatable hydrophilic layer to form a tacky fastenable polymeric label free of bubbles and uneven adhesive streaks typical of the standard deposition of adhesives applied on  
30 aqueous labelers;
- (c) fastening said fastenable polymeric label to a glass, plastic or metal container or surface; and
- 35 (d) curing said polymeric label on said glass, plastic or metal surface or container.

For opaque or metalized labels, special mention is made that it is preferable to use a coextruded polymeric label

5 substrate with a cavitated or voided adhesive surface  
producing micro-voids or pores on the adhesive side in  
combination with a porous core. Typically these types of  
label substrates have a density  $<0.9$  where the adhesive  
penetrates the rear plane of the label wherein said polymer  
10 label contains a portion of said dried water based adhesive  
within said voided or cavitated polymer label.

The use of the low density micro-voided polymer film can  
allow portions of the water based adhesive to migrate into  
15 the film during the drying cycle to provide an enhanced bond  
between the polymeric label and the container surface and to  
also impart stiffness to the dried label on the container  
surface. Additionally, the weak internal strength of the  
voided material provides the appearance of superior bond  
20 when it is attempted to remove the label because it  
fractures apart at minimal force. Additionally, the pores  
create greater surface area for bonding versus a polymeric  
film with a smooth adhesive surface.

Most importantly, it has been found that voided substrates  
25 with a porous adhesive side that are judiciously applied  
with a hydrophilic layer on the adhesive side show superior  
adhesion when rewet and pressed onto the glass metal or  
plastic container because the voided area or open area of  
the pore has a greater surface area than a non voided smooth  
30 surface and appears to act as a suction cup when the air in  
the cavitated or voided area is pressed out as the label is  
applied providing an improved bond while pulling activating  
aqueous medium into the pores.

### 35 DETAILED DESCRIPTION OF THE INVENTION

Pre-applied activatable hydrophilic materials containing  
animal glue that can function as an adhesive are formulated

5 so that their coefficients of expansion or contraction,  
thickness and modulus of elasticity when applied to a  
polymer film will result in a polymeric film facestock that  
will have hydrophilicity, absorbtivity, wet tack and drying  
properties that will permit the polymer film to be applied  
10 to polymeric, glass or metal containers via water based wet  
labeling techniques on standard paper labeling equipment.  
The apparatus which is used to apply paper labels is well  
known to those in the art. The polymeric label substrate  
with the activatable hydrophilic layer will demonstrate  
15 sufficient "wet tack" during the label application period  
and the label drying period to permit containers to be  
handled and processed. The polymeric film based facestock  
will provide a label with printability, chemical and  
dimensional stability, resistance to cracking, tearing,  
20 creasing, wrinkling or any other degradation of the sort  
experienced by paper labels due to physical or environmental  
extremes.

The invention also permits the use of hydrophilic layer  
25 activatable by a water based solution into an adhesive to be  
used to fasten a clear or contact clear polymeric film  
substrate which is reverse printed and then over coated with  
the activatable hydrophilic layer to a container. As used  
herein the reference to a "container" includes a surface of  
30 an object made of glass, plastic or metals such as bottles,  
cans, toys and building materials.

The activatable hydrophilic component or blends containing  
animal glue will be applied in the present invention to the  
35 selected polymeric sheet in a continuous or patterned layer  
to provide the absorptive, wet tack and drying properties  
that are necessary to enable polymeric sheets to be  
successfully used as label substrates on polymeric or glass  
containers when activated through wetting with water, water  
40 and a cross-linker, adhesive or adhesive and a cross-linker

5 using water based wet labeling techniques where the  
apparatus is configured to apply the minimum amount of  
aqueous solution to activate the layer into a tacky adhesive  
when wet, but not excess aqueous medium to saturate the  
activatable layer causing it to loose its adhesive  
10 properties and not adhere well and take a long time to dry.  
The activatable hydrophilic layer, containing at least 30%  
by weight of animal glue which may be applied by either a  
coating, coextrusion or an extrusion technique, has the  
function of absorbing moisture to activate the layer as an  
15 adhesive when wet with an aqueous medium thus causing  
selected hydrophilic layers to function as an adhesive  
without any applied adhesive as is conventionally performed  
on aqueous labeling machines in the art or to activate by  
absorbing the moisture from an aqueous adhesive if used, to  
20 cause the polymer film to adhere to the glass, plastic or  
metal container and to set up rapidly and positively. Key to  
this invention is the minimization of the aqueous medium  
used to activate the hydrophilic layer as an adhesive.  
Excess activation moisture can decrease the tack of the  
25 activated layer as it becomes saturated with moisture and  
will lead to longer drying times and loss of adhesion  
properties.

It is also possible to coextrude the activatable hydrophilic  
30 layer with the polymer film layer.

The choice of polymeric substrate for the label film will  
determine the rigidity, deformability or conformability,  
regrindability, printability and expansion or contraction  
35 characteristics required for application to the selected  
container without the problems associated with paper labels.

In addition, the polymeric film substrate for the label will  
be selected so that it will expand or contract to the same  
40 degree as the container so that when ambient conditions

5 change, the label will not pucker or blister.

The polymeric materials include clear, opaque or colored polypropylene, polyethylene, polyester, polystyrene, polycarbonate, vinyl, cellophane or compatibilized blends.

10

The term "film facestock" or "polymeric label substrate" as used herein should be taken for purposes of the present invention to refer to a material compatible in terms of rigidity, deformability or conformability, recyclability if a plastic container and expansion or contraction characteristics with the plastic or glass container to be labeled. Similarly, the "activatable hydrophilic layer" previously mentioned has the properties of minimal tack when dry so labels can be unwound from a roll or separated from a stack and once activated with moisture, it will have the properties of wet tack, absorbtivity, drying, sufficient adhesion to the polymeric label substrate and affinity and adhesion to the container or labeling adhesive if used as an activating medium in the wet or dry form.

25

Activatable hydrophilic layers containing animal glue can be wet or remoistened without adhesive for use on a glass, plastic or metal container or a water based adhesive can be used to activate and affix the polymeric label substrate with the activatable hydrophilic layer to the glass, plastic or metal container. For deformable containers, the hydrophilic layer activated into an adhesive is formulated to form a bond with the container and the polymeric film substrate such that when dry, the strength of the container wall-hydrophilic adhesive interface and the cohesive strength of the adhesive itself are all greater than the forces required for deformation of the label.

35

As used herein and in the appended claims, the term "hydrophilic" is used to describe materials or mixtures of

40



5 materials which bind, pass or absorb water. The term  
"activatable hydrophilic layer" describes a hydrophilic  
layer that when binding, passing or absorbing water becomes  
activated and transforms into an adhesive layer with wet  
tack and affinity for the container to be labeled. The term  
10 activated as used herein describes the change in a dry pre-  
applied dry hydrophilic layer on a label substrate to a wet  
adhesive layer when activated with an aqueous medium that  
will adhere to the container wall to be labeled, dry and set  
up with strong adhesion.

15 The preferred "activatable hydrophilic" materials of the  
present invention are based on animal glue coating which in  
broad terms is an organic colloid of protein derivation from  
collagen which is a protein constituent of hide materials  
20 and bones obtained using well know techniques widely used to  
provide many commercially available glues. Hide animal glue  
is preferred over bone animal glue because of superior  
physical properties and strength. The animal source is not  
critical and glues may be derived from wild or domesticated  
25 animals such as horses, cattle, pigs, sheep and the like.  
Purified versions of animal glue are also known as gelatin.  
Animal glues are commonly graded on comparative gel gram  
strength values by manufacturers and provides a rough guide  
for use but this standard does not always measure their  
30 working qualities as adhesives for glass, plastic and metal  
containers. Considerations of gram strength, pH, ash  
content, clarity, grease content, type of glue (bone of  
hide), degree of purification and processing methods all  
have a bearing. The gram strength measurement of animal glue  
35 is also known as a gel strength measurement which ranges  
from about 30 grams (weak) to 500 grams (exceptionally  
strong) where the highest gram strengths contain greater  
amounts of reactive glue protein. Typically, stronger  
adhesive bonds are achieved with higher gram strength animal  
40 glues and blends of animal glues. Unfortunately, as gram

- 5 strength increases, so does the dry brittleness of the glue which must be addressed in formulating using modifying components such as plasticizers, humectants and modifying synthetic resin dispersions.
- 10 In physical form, dry animal glues are odorless, relatively tack free hard materials ranging in clarity from light amber to dark brown depending on the origin, processing technique and degree of purification that contain 10 - 14% moisture. Almost all grades can be made up into aqueous solutions and
- 15 many can be melted and applied at temperatures less than the boiling point of water such as through a die or extruder as long as it is vented for potential moisture that could flash off. For a clear polymeric substrate, clarity or contact clarity of a thin activatable hydrophilic layer comprising
- 20 at least 30% animal glue by dry weight dictates that relatively clear and pure animal glue is preferably used.

In water, solutions of animal glues based on hide which are typically the higher gram strength variety preferred for use

25 in this invention instead of bone based glues are generally reaction neutral and have a pH range of 6.4 - 7.4 which is a pH that makes them compatible with many other materials. The specific gravity of dry animal glue is approximately 1.27.

- 30 An important feature of animal glue in the present invention is that when dry animal glue is placed in cold water like an ice chest for beverages, animal glues do not dissolve readily but swell absorbing considerable water forming a gel
- 35 state and must be heated to dissolve into solution at 100 - 140 °F. The rapid development of a gel state when wet with an aqueous medium provides a fast set and tackiness with quick development of initial bond and holding strength which is critical for the successful application of polymeric
- 40 labels to glass, plastic and metal containers using wet

5 labeling techniques. For applications where long term  
contact with water and subsequent swelling of the animal  
glue could cause a loss of adhesion, it is preferred to  
crosslink the animal glue to make it moisture resistant. One  
10 of the keys to this invention is maintaining the beneficial  
properties of non cross-linked animal glue for label  
application using at least 30% animal glue in the  
activatable hydrophilic layer which is then cross-linked and  
rendered moisture resistant after application by the water  
containing a cross-linker or adhesive containing a cross-  
15 linker which is applied when the hydrophilic layer is  
activated into an adhesive. High speed labelers run from 200  
- 1,200 container per minute and the cross-linking reaction  
is relatively slow at even at high levels of cross-linker so  
the layer can be wet, develop tack and adhesion to the  
20 container to be labeled and cure to moisture resistant over  
time. This time period varies depending on the activatable  
layer formulation, cross-linker of choice and amount of each  
component used along with the amount of water that must be  
absorbed and dried. The time period can run from 12 hours to  
25 14 days but stable formulations that are rendered moisture  
resistant in 72 hours are adequate for most commercial  
labeling applications. A key advantage of cross-linked  
activated adhesives consisting predominantly of animal glue  
is that when dry and rendered moisture resistant, the  
30 adhesive is not impervious and hard and in fact the adhesive  
layer will "give" or move slightly under high moisture  
conditions and contact the surface to be labeled on drying  
providing a "live" adhesive bond that takes up the  
stresses and strains that normally occur under labeling and  
35 drying conditions. Another key benefit of an adhesive layer  
containing animal glue that forms a gel structure is that if  
the surface to be labeled is cool, the animal glue component  
will gel faster and set a bond faster because it is less  
fluid. This can be an important factor in brewery  
40 applications where post mold labeling of cold beer or cold

5 storage of labeled containers can accelerate the bond of the  
activatable layer.

Another important feature of animal glue layers,  
particularly those deposited from water or wet with water is  
10 that when dry, they exhibit high adhesive strength, are  
continuous, non-crystallizing, non-cracking and of great  
strength and elasticity. Additionally, animal glue is  
reaction neutral, relatively odorless, non toxic and non  
corrosive. Due to its unique protein structure, animal glue  
15 is not precipitated by acids or alkali's and is resistant to  
structural breakdown by acids or alkali's within normal  
practical limits so for use as a labeling adhesive where the  
contents of a container could leak or drip down the side of  
the container and attack the adhesive, animal glue is  
20 durable. Animal glue based adhesives are also resistant to  
grease, oil, alcohol and other chemicals that are free of  
water and as stated above, to overcome moisture sensitivity,  
animal glue can be rendered moisture resistant by cross-  
linking.

25.

For glass containers, it is preferred to use high gram  
strength animal glues at a level of at least 50% dry by  
weight of the activatable hydrophilic layer to achieve a  
30 strong bond where the gram strength of the animal glue is  
greater than 50 grams. More preferably, for glass containers  
a dry level of animal glue between 50 - 80% is preferred as  
is a gram strength in excess of 200 grams (also known as gel  
strength). The higher the gel strength of the animal glue,  
35 the stronger the adhesive bond to glass will typically be.  
Animal glue shows a specific affinity for glass and coated  
glass and is ideal as a base polymer to be formulated into  
an activatable hydrophilic adhesive layer because of its  
strong wet tack and affinity for glass. Animal glue has such  
40 a strong affinity for glass that some formulations when dry

5 and adhered to the glass will pull glass particles with it  
when removed. This has been proven by those that use animal  
glue to create chipped glass or frosted glass decorative  
designs using animal glue allowed to dry on glass that is  
subsequently removed. This high affinity and bond strength  
10 to glass is why animal glue is the key component of this  
invention for activatable layers on polymeric films for high  
speed post mold labeling.

For plastic containers, it is recommended to blend synthetic  
15 acrylic polymers which bind or absorb water and become  
adhesives such as polyacrylic acid, polyacrylic acid  
copolymer or carboxylated sodium polyacrylate with the  
animal glue to promote adhesion to the plastic container  
wall. For plastic containers, the dry animal glue level in  
20 the activatable layer can range from 30 - 80% but it is  
preferred at a level of 35 - 45% in combination with  
synthetic polymers. Moisture sensitive synthetic polymers  
that can be rendered insoluble through cross-linking can be  
added at levels up to 65% dry polymer

25 Amounts of non moisture sensitive synthetic polymers can  
also be added as modifiers at levels up to 50% dry polymer.  
If synthetic polymers are used, they can be in the form of  
solutions, dispersions and emulsions but solution polymers  
30 are preferred.

In addition to synthetic resins as discussed above, animal  
glue solutions are compatible with select natural resins,  
modifying additives such as plasticizers, oils, fats, waxes  
35 along with other adhesive materials such as casein, starch,  
dextrine and gums under certain conditions.

To plasticize and increase the flexibility of animal glue  
and control lay flat, modifiers such as urea, polyethylene  
40 glycol, glycerin, sorbitol, cane or invert sugars or

5 combinations of the preceding are added at levels up to 20%  
dry depending on the properties desired but preferably at  
levels < 7% if the activatable layer is subsequently to be  
reacted (cross-linked) to be rendered resistant to moisture  
10 to minimize the level of non-reactive components in the  
matrix of the activatable hydrophilic layer. It is noted  
that urea acts as a gel dispersant to reduce the viscosity  
of the gel for coating applications while it is inert in the  
animal glue matrix.

15 A discussed above, a preferred aspect of the present  
invention is to use cross-linkable (reactive) components in  
the activating aqueous solution to react with the  
hydrophilic layer that converts into an adhesive that cures  
to become more moisture resistant as it dries and builds  
20 adhesion to the container wall. Not only does the cross-  
linking agent make the activated adhesive more moisture  
resistant, it promotes adhesion to the container wall while  
increasing chemical resistance to materials that may come in  
contact with the adhesive layer. Examples of synthetic  
25 cross-linkable materials are those which contain carboxyl  
groups, hydroxyl groups or other functional group which will  
react with a cross-linking agent. The cross-linking agent  
can also be added to an adhesive used to wet and activate  
the hydrophilic layer. When water and a cross-linking agent  
30 are combined, the composition will comprise 0.005 -10% by  
wt. of cross-linking agent.

The coated, extruded or coextruded activatable hydrophilic  
layer converts to a wet tacky adhesive layer when wet with  
35 an aqueous solution which is defined as a substance capable  
of combining two surfaces by the formation of a bond. If a  
light deposition of an aqueous adhesive is used as the  
activating medium, the activatable hydrophilic layer bonds  
to the polymeric film substrate and the glass, metal or  
40 polymer of the container wall when dry.

5 The use of the properly formulated activatable hydrophilic layer for a given polymeric labeling substrate and container to be labeled will have a direct effect on the speed which the labeling line can be run. When considering the choice of the activatable material which forms the hydrophilic layer, 10 which may be applied by coating, coextrusion or extrusion, one must consider the label substrate, container to be labeled, labeling machinery, activation technique and downstream processing requirements such as filling, conveying and packing. In addition the final appearance of the label 15 such as the clear no label look or a plain opaque or metalized label must be considered in the choice of the components of the hydrophilic layer. Generally, a deposit of from 0.25 to 8 lbs./3000 square feet of the activatable hydrophilic layer, when dried, may be employed on the 20 polymeric film layer, depending on the particular material that is selected and the method that is used to apply the layer such as coating, coextrusion or extrusion.

It is critical to the successful application and use of an 25 activatable hydrophilic polymeric film label to control how the water or water based adhesive is applied to the activatable hydrophilic layer, how deposition (weight or thickness) is controlled and how the resultant combination with the container is pressed together. Generally, from 0.05 30 to 2.5 g. /sq. ft. of activating medium (water or water based adhesive) is applied to the pre-applied activatable hydrophilic layer with 100% coverage of the label. If a grid or other pattern of activating medium is employed, then the amount of activating medium may be reduced. If a grid 35 pattern is employed, the hydrophilic layer may be applied to be substantially in register with the activating medium.

It is critical to the successful application and use of an activatable hydrophilic polymeric film label to precisely 40 control how the amount of aqueous activating fluid medium

5 (water, water plus a cross-linker, adhesive or adhesive plus  
a cross linker) is applied. Too much aqueous medium for a  
given deposition of activatable hydrophilic layer will  
overpower the layer and will result in loss of tack and  
initial adhesion and will result in labels "swimming" or  
10 moving as the labeled container is conveyed, filled or  
packed and will increase the drying time of the activated  
layer to produce a firm adhesive bond to the wall of the  
labeled container. Not enough aqueous activating medium will  
not completely develop the full adhesive properties of the  
15 activatable layer and will result in poor bonds. As with any  
adhesive labeling technique, the type of bond achieved is a  
fine balance between the container surface to be labeled,  
the label material, adhesive formulation which in this case  
is the activatable hydrophilic layer in combination with the  
20 aqueous activating fluid and the deposition of the activated  
adhesive. For purposes of this invention, the adhesive layer  
is the combination of the activatable hydrophilic  
formulation and the activating medium whether it is water,  
water and a cross-linking agent, adhesive or adhesive and a  
25 cross-linking agent. The ultimate adhesion properties are  
controlled by the choice of adhesive layer formulation and  
deposition of the adhesive layer

30 When using an adhesive or adhesive and cross-linker as the  
activating fluid, it will generally be possible to reduce  
the typical amount of adhesive applied to the activatable  
hydrophilic layer of the label to an amount which is <40% of  
the amount that is typically employed for affixing paper  
35 labels to a surface and preferably less than 20%. For  
example from 0.02 g. to 0.7 g. /sq. cm. may be used for the  
preparation of labels manufactured from polymeric films with  
a thickness range from 1.5 to 8 mils.



5 The choice of the adhesive layer made up of the activatable  
hydrophilic layer and activating medium, the type of label  
substrate and container to be adhered together, the plant  
processing conditions after labeling, storage requirements  
10 and the end use requirements that must be met such as high  
temperature resistance, ice proofness or passing a 24 - 72  
hour ice bath soak are important considerations. There are  
many more specific variables within these considerations all  
of which influence the formulation of the proper activatable  
hydrophilic layer and activating medium for a specific  
15 application.

The bonding of the activatable layer can be accomplished  
with mechanical (non smooth surfaces) and specific adhesion.  
It has been found that the preferred animal glue component  
20 of the activatable layer provides superior adhesion  
characteristics when the layer is activated by water or a  
water based adhesive containing a cross-linking agent or a  
combination of cross-linking agents such as zirconium salts  
of mineral acids, such as Bacote 20 from Magnesium Elektron,  
25 Inc., water soluble polyamide-epichlorohydrin material such  
as Polycup 172 from Hercules, Glyoxal available from BASF  
Corporation or an aldehyde donor such as Glutaraldehyde that  
rapidly cross-links the animal glue and the like which may  
be used at a level of 0.01-8% by weight of the activatable  
30 layer composition.

Mechanical adhesion is defined as the bonding between  
surfaces in which the adhesive holds the parts together by  
inter-locking action and actual physical penetration.  
35 Specific adhesion is the bonding between surfaces which are  
held together by molecular forces wherein the surfaces are  
non porous and no penetration is possible. These forces are  
related to the polarity and size of the molecules, pore size  
of non smooth surfaces and the initial action in obtaining a  
40 bond when the activated surface is wet, becomes tacky and a

5 bond develops through molecular forces.

In mechanical as well as specific adhesion, the activated hydrophilic layer must "wet" both surfaces completely or weak bonded areas will develop as it dries or "sets" resulting in a poor bond. Not only is wetting of the surfaces critical, penetration is also important and this is why a polymeric film that is cavitated, voided or porous on the activatable side is a preferred embodiment of the invention in combination with the activatable hydrophilic layer which is penetrated to a degree by the aqueous activating medium. Penetration is important since most combinations of surfaces to be adhered together involve at least one porous or absorptive surface which controls the "setting" characteristics. The preferred low density polymeric labels are made of polypropylene which is commercially available. The preferred density is 0.45 to 0.85; an especially preferred density is 0.50 to 0.65, as distinguished from the conventional polypropylene label stock which has a density above 0.9. These materials are sometimes referred to as cavitated, micro voided or foamed polypropylene. Other polymers which may be used include polyethylene, polyester, polystyrene, cellophane, polycarbonate or compatibilized polymer blends. It is preferred to utilize a low density polymeric label substrate in conjunction with a hydrophilic material such as the activatable hydrophilic layer on the polymeric label to allow for more rapid escape of water from the activating medium that is placed on the activatable hydrophilic layer on the back or adhesive side of the low density polymeric label. One common technique to create cavitation or voids in a stretched polymeric film is to use incompatible particles that separate and create a void or pore as the polymeric film is stretched. A common particle used for creating cavitation or pores is calcium carbonate and animal glues have a strong affinity and bond for calcium carbonate that

5 is typically found in many voided polymeric film layers the  
activatable adhesive composition will be applied to so it  
will have superior adhesion.

10 For non porous polymeric film substrates, to facilitate  
wetting of the surface and penetration, the activatable  
hydrophilic layer and activating fluid that combine into the  
adhesive must wet out the surface of the container to be  
labeled. This is accomplished by applying the activating  
15 medium to the selected activatable hydrophilic layer which  
when applied to the container to be labeled brings the  
hydrophilic layer activated into an adhesive and container  
wall into intimate molecular contact. By using an aqueous  
fluid activating medium that wets and penetrates the  
20 hydrophilic layer as well as the container surface, a fluid  
region is created that flows to cover the surface as  
completely as possible. This is critical to the invention  
where even an apparently smooth surface in reality is  
composed of a random network of hills and valleys. When the  
activated hydrophilic layer is in the wet condition, it  
25 serves as a wetting bridge to promote adhesion.

As previously mentioned, various commercially available  
adhesives at significantly reduced coat weight can be used  
as the aqueous activating medium with activatable  
30 hydrophilic layers to provide good adhesion of polymeric  
film layers to a plastic or glass surface. These materials  
include starch based adhesives or casein based adhesives now  
predominantly used for glass applications since they do not  
bond well to plastic or metal. Specific adhesives that may  
35 be employed include EVA based materials which have free  
carboxyl groups, converted starch solutions, PVA based  
adhesives, casein based adhesives, synthetic resin  
dispersions for metal or plastic containers or blends of  
synthetic and starch based products and the like.

40

5    Optionally, if just water or water and a cross-linking agent  
are used as the activating medium, it is preferred to  
thicken the water or solution for better machining on the  
labeler that is designed to handle higher viscosity mediums  
such as conventional labeling adhesives. Many commercially  
10   available thickeners can be used but special mention is made  
of the Laponite family of synthetic thickeners from Southern  
Clay Products that form a gel structure of an aqueous  
solution at low addition levels that will not overpower the  
adhesive properties of the activated medium and will not  
15   interfere with the ultimate bond or moisture sensitivity of  
the dry adhesive at the low levels used to thicken the  
aqueous solution.

It is clear that one specific activatable hydrophilic layer  
20   may not fit all applications but it has been found that the  
activatable hydrophilic layers of the present invention can  
be tailored to particular applications based on the  
conditions and requirements for wet PML labeling of  
polymeric substrates but the activatable layer must contain  
25   at least 30% by weight of the dry activatable layer of  
animal glue that when activated (wet) by an activating fluid  
medium becomes sufficiently tacky to adhere a polymeric  
layer to a container through filling, conveying, processing  
or packing that will subsequently dry and provide good  
30   adhesion to the container. When working with natural and  
synthetic activatable layers that are obviously sensitive to  
moisture, it is important depending on the moisture  
sensitivity of the formulation to add a humectant to the  
activatable layer at a level of 0.25-10% by dry weight to  
35   provide curl resistance and to impart lay flat properties to  
the polymeric film labels. The humectants also tend to act  
as plasticizing agents so the activatable layer does not  
become too brittle when dry and include urea, polyethylene  
glycols such as PEG400, polyvinyl alcohol, glycerin,  
40   sorbitol and the like.

5

For a coextruded product, if an adhesion promoting tie layer is employed, materials such as maleic anhydride, ethyl acrylic acid and the like may be employed at levels up to 5% by weight of the hydrophilic composition. For a coated

10 product, if a primer is employed, materials such as chlorinated polypropylene, polyethylene imine (PEI), acrylic primers and the like may be employed at levels of 0.05-1.0 lbs/3000 sq. ft. Special mention is made of acrylic resin based primers that are filled with a silicate such as  
15 colloidal silica also known as "water glass" that has demonstrated superior adhesion characteristics to animal glue that has a high natural affinity for glass and silicates such as alkali metal silicates.

20 Slip aids and anti-blocking compounds commonly used in the art can prevent excessive friction between the activatable hydrophilic layer and the printed label face and also control the effect of ambient moisture levels which may tend to cause label blocking and interfere with the operation of  
25 high speed automated machinery which is used to apply labels. These materials may be used at a level of 0.2-5% by weight of the activatable layer composition and/or the protective over coat applied over the printed indicia on the side of the label opposite the activatable layer and include  
30 materials such as microcrystalline wax emulsions, erucamide dispersions, polytetrafluoroethylene compositions, silicone beads, modified silicone solutions, parafin wax emulsions, high melting polypropylene emulsions, carnauba wax emulsions, oxidized ethylene/EVA compositions, micronized  
35 polyethylene wax/PTFE emulsions, micronized polypropylene, micronized fluorocarbons such as PTFE (Teflon), micronized polyethylene, silica and talc.

Protective coatings may be used to protect the exposed  
40 polymer film and printed indicia of the label when applied

5 at a level of 0.25-4 lbs. /3000 sq. ft. using conventional application techniques. These materials include styrenated acrylics such as OC1043 from O.C. Adhesives Inc., urethanes such as AS455 from Adhesion Systems Inc., Flexcon Release Varnish from Flint Ink.

10

If an antistatic agent is employed in the printable over coat applied over the indicia, it may be present at a level of 0.5-3% by weight of the dry coating. These materials include quaternary ammonium salts such as Ethaquad C12, 15 sulfonated styrene maleic anhydride, sulfonated polystyrene, sulfonated vinyl toluene maleic anhydride, conductive polymers and organo modified silicones such as Silwet L77. It is noted that anti-static agents are typically not needed in the activatable layer because the high moisture content 20 of the animal glue provides exceptional static elimination properties.

Optionally, if a metalized coating of a thin metal film is deposited on the polymeric sheets or rolls, premium quality 25 decorative labels with all of the advantages set forth above will be provided.

It is clear that one specific activatable hydrophilic layer may not fit all applications but hydrophilic layers can be 30 tailored to particular applications based on the conditions and requirements for wet PML labeling of polymeric substrates.

If an adhesion promoting tie layer or primer is employed to 35 promote hydrophilic layer adhesion or adhesive adhesion, materials such as maleic anhydride, ethyl acrylic acid, carboxylated polyurethane resin and the like may be employed at levels of 0.1-3 lb/3,000 sq. ft.

5

If a cross-linking catalyst is added to the adhesion promoting tie layer, the ratio of catalyst to adhesion promoting tie layer may be an amount that is sufficient to cure the adhesion promoting tie layer. An excess of the catalyst, i.e. 5-25% in excess of the amount of the catalyst that is required to cure the adhesion promoting tie layer may be used to provide a portion of the catalyst at the interface of the adhesion tie promoter and the hydrophilic layer to increase the moisture resistance of the hydrophilic layer without decreasing the moisture absorbtivity of the hydrophilic layer. Additionally, excess catalyst can also be available to aid in curing of the adhesive.

20 Plasticizers such as n-di-octylphthalate may be employed at a level of 0.5-3% by weight of the adhesive composition to prevent the polymeric film label from losing flexibility.

25 The slip aids and anti-blocking compounds prevent excessive friction between the hydrophilic layer and the adhesive layer and also control the effect of ambient moisture levels which may tend to interfere with the operation of high speed automated machinery which is used for apply labels. These materials may be used at a level of 0.5-3% by weight of the hydrophilic composition or may be coextruded or coated with the low density film and include materials such as microcrystalline wax emulsions, erucamide disp, polytetrafluoroethylene compositions, silicone beads, modified silicone solutions, parafin wax emulsions, high melting polypropylene emulsions, carnauba wax emulsions, 35 oxidized ethylene/EVA compositions, micronized polyethylene wax/PTFE emulsions, micronized polypropylene, micronized fluorocarbons such as PTFE (Teflon), micronized polyethylene, silica and talc.

40 If an antistatic agent is employed, it may be present at a

- 5 level of 0.5-3% by weight of the hydrophilic formulation.  
These materials include quaternary ammonium salts such as  
Ethaquad C12, sulfonated styrene maleic anhydride,  
sulfonated polystyrene, sulfonated vinyl toluene maleic  
anhydride conductive polymers and organo modified silicones  
10 such as Silwet 77.

Protective coatings may be used to protect the exposed  
polymer film of the label when applied at a level of 0.25-4  
lbs/3000 sq. ft. using conventional application techniques.

- 15 These materials include styrenated acrylics such as OC1043  
from O.C. Adhesives, Inc., Flexon Release Varnish from  
Manders-Premier.

- 20 If desired a humectant may be added to the hydrophilic layer  
at a level of 0.5-3% to provide curl resistance and to  
impart layflat properties to the polymeric film labels.  
These humectants include urea, polyethylene glycols (such as  
PEG400), polyvinyl alcohol, glycerine and the like.



5 I claim:

A process for applying a polymeric label to a glass, plastic or metal container or surface said process comprising:

- 10 (a) applying a layer of a hydrophilic solid material comprising at least 30% by dry weight of an animal glue to a polymeric label and thereafter drying said layer of hydrophilic material to form a water activatable hydrophilic layer that can be activated into a tacky fastenableable adhesive;
- 15 (b) applying a sufficient amount of water, water containing a cross-linking agent, a water based adhesive or a water based adhesive containing a cross-linking agent to said activatable hydrophilic layer to form a tacky fastenable
- 20 polymeric label;
- (c) fastening said tacky fastenable polymeric label to a glass, plastic or metal container or surface; and
- 25 (d) curing said polymeric label on said glass, plastic or metal surface or container.

## Abstract

The invention provides a method for fastening a polymeric label to a glass, plastic or metal container or surface by means of a water based composition containing at least 30% by dry weight of animal glue that is activated into an adhesive by the following steps: (a) applying a layer of a hydrophilic solid material based on at least 30% by weight on protein from animal renderings to a polymeric label to form a hydrophilic layer that acts as an adhesive layer when activated with an aqueous medium; (b) applying a low deposition of water, a water based adhesive, water containing a cross-linking agent or an adhesive containing a cross-linking agent to the activatable hydrophilic layer sufficient enough to activate it into an adhesive and form a fastenable polymeric label; (c) fastening the fastenable polymeric label to a glass, plastic or metal container or surface; and (d) allowing said the polymeric label to dry on the glass, plastic or metal container or surface. Special mention is made using polymeric substrates that are optically clear or substrates that are opaque, especially where the opacity is achieved by cavitation or voiding of the substrate to produce pores or voids on the adhesive side of the label while reducing the density of the label substrate.